FROM SERPENT TO CEO:
IMPROVING FIRST-TERM SECURITY FORCES AIRMAN PERFORMANCE THROUGH NEUROSCIENCE EDUCATION

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Strategic Studies

by

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The implementation of Defender's Edge, a mental health performance program specifically designed for Air Force Security Forces personnel, is significant to introducing neuroscience concepts into operations to mitigate resultant risks. However, a deeper understanding of neuroanatomical and physiological considerations affecting young adults would improve reflexive performance in judgment-dependent situations. Neuroscience education offers novel enhancements to training, operations, and Defender's Edge to reduce risk and increase cognitive performance abilities in young adults.

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ABSTRACT

FROM SERPENT TO CEO: IMPROVING FIRST-TERM SECURITY FORCES AIRMAN PERFORMANCE THROUGH NEUROSCIENCE EDUCATION, by Major Michael J. Cheatham, 87 pages.

United States Air Force Security Forces relies heavily on young adults and their ability to apply judgment while under threat. Security Forces assumes inherently greater risks than its civilian counterparts; it relies on a core population of young adults between 17 and 25 years old as primary first-contact sentries, patrolmen, and combat operators. Current research indicates the human brain requires at least 26 years to reach full maturation.

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I completed this research as both a personal interest and as an attempt to further develop the individual capabilities of first-term Security Forces Airmen and contribute to the intellectual development of all Airmen. It is my greatest honor to serve amongst them. If there are any mistakes, errors, or omissions they are mine and mine alone.

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ACRONYMS

ANS	Autonomic Nervous System
CAF	Comprehensive Airman Fitness
CEO	Chief Executive Officer
DEFED	Defender’s Edge
fMRI	Functional Magnetic Resonance Imaging
PNS	Parasympathetic Nervous System
SNS	Sympathetic Nervous System
USAF	United States Air Force

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CHAPTER 1

INTRODUCTION

> It is an exceptional man who keeps his powers of quick decision intact if he has never been through this experience before. It is true that (with habit) as we become accustomed to it the impression soon wears off, and in half-an-hour we hardly notice our surroundings any more; yet the ordinary man can never achieve a state of perfect unconcern in which his mind can work with normal flexibility.
>
> — Carl von Clausewitz

Overview

Security Forces is the principal military police, physical security and integrated defense branch on United States Air Force (USAF) bases and various joint installations (USAF 2011, 10). In garrison, Security Forces operates in capacities similar to traditional off-base civilian law enforcement counterparts. However, unlike its civilian counterparts Security Forces also maintains readiness in a broad array of additional competencies to function within the broad range of military operations. In deployed environments, Security Forces performs base defense, stability operations, and limited wide-area security-type duties. As a formal branch within the USAF, the researcher refers to Security Forces as a proper noun and a singular entity.

A significant flashpoint in current American culture surrounds perceptions of unreasonable escalation of use-of-force by civilian law enforcement officers in ambiguous circumstances. Security Forces is not experiencing scrutiny similar to off-base sister law enforcement agencies; however, its commanders may not clearly understand the risks of fielding a force primarily composed of young adults (Smith and Aamodt 1997, 57; Paoline and Terrill 2007, 192-193; Aamodt 2004, 51; Jenkins and DeCarlo

2014). More significantly than broad mission sets, Security Forces assumes intrinsically greater risks than its civilian counterparts. Its heavy dependence on a core population of young adults to perform as primary first-contact sentries, patrolmen, and combat operators sets it apart (McElvain and Kposowa 2008, 510).

Security Forces relies heavily on young adults and their employment of cognitive skills and judgment under threat more than brute physical abilities. Yet the dynamic spectrum of required mission-essential training tasks coupled with personnel and resource constraints, operational mission demands, and ingrained cultural resistances inhibit Security Forces' young adult development efforts. Experiential motor learning, i.e., "crawl-walk-run," and individual needs-based training programs of optimal quality and quantity suffer (Dirksen 2012, 35-54). As a result, Security Forces Airmen train from a generalist rather than specialist perspective (USAF 2014b, 6).

What risks do first-term Security Forces Airmen pose that are greater than what off-base law enforcement counterparts experience and why should leaders be concerned? Beyond providing baseline career field education and resilience-based training, what additional training should Security Forces consider? Are education and neural understanding valid predictors of law enforcement decision-making? What cultural norms within Security Forces should be challenged to improve responses of young adults faced with perceived high-threat situations? These questions form the basis of substantive hypothesis development.

The linkage between young adults and cognitive processing in high-threat situations is an enduring military consideration. Nearly two centuries ago, Prussian military theorist Carl von Clausewitz remarked how the unpredictable nature of war

creates cognitive dissonance, or “fog,” in the minds of young soldiers. Clausewitz recognized when a soldier mentally processes both environmental conditions and the threats themselves fog pervades (von Clausewitz 2008, 108). Neuroanatomical limitations stemming from developmental age and relative experience may further amplify fog in chaotic or complex operating environments.

In his classic military tome, *On War*, Clausewitz notes, “Ordinary men…tend to lose self-confidence when they reach the scene of action: things are not what they expected” (von Clausewitz 2008, 77). Modern era soldiers and law enforcement officers are no different; first-term Security Forces Airmen share similar cognitive reactions in high-threat activities to what Clausewitz observed. Today, the U.S. Department of Justice recognizes, “[Law enforcement] officers are often forced to make split-second judgments in circumstances that are tense, uncertain, and rapidly evolving” (U.S. Department of Justice 2016).

Clausewitz asserted individuals could decrease fog felt in war through the development of judgment and experience resulting from training and maturity (2008, 177). Modern neuroscience is confirming what Clausewitz previously contemplated (Moseley 2007, 171). Current research indicates there are fundamental neuroanatomical limitations and physiological implications that affect how young adults interpret and react to perceived high-threat situations (Jensen 2015, 37; Sapolsky 2004, 229; Satterfield 2013, 25). While cognitive dissonance in threatening situations is not limited to young adults, the lack of emotional development, maturity, and brain interconnectivity affects the judgment of young adults to a greater extent than mature adults (Gogtay et al. 2004, 8177; Jensen 2015, 37; Strauch 2003, 91-96).

Research Question

Deeper consideration of young adult neuroanatomical limitations begins with the primary research question, “Should Security Forces incorporate neuroscience education into training for first-term Airmen?” The researcher acknowledges this is not the first consideration of a military-backed neuro-based education approach. In the aftermath of World War II, trailblazing civilian and military scientists teamed to produce practical manuals designed to improve battlefield performance and post-war resilience (Mastroianni et al. 2011, xv). Those books, entitled *Psychology for the Fighting Man* (1943) and *Psychology for the Returning Serviceman* (1945), provided guidance on the most advanced scientific beliefs at the time (Mastroianni et al. 2001, xv). Today, the accessible body of neuroscience and resulting implications are exponentially greater than ever before; the difficulty lay in its interpretation and application.

Sixty-five years after the publishing of *Psychology for the Returning Serviceman*, the USAF introduced the *Comprehensive Airman Fitness* (CAF) program. Founded on components of the U.S. Army’s *Comprehensive Soldier Fitness* program, CAF exists to increase individual resilience and, thus, improve general Airman performance (ACC Public Affairs Office 2010). Subsequent to CAF implementation, Security Forces initiated a branch-specific resilience and performance-based program, *Defender’s Edge* (DEFED) (USAF 2011, 3). Grounded in the warrior ethos, i.e., élan, and moral and physical courage, DEFED seeks to provide a framework to forge and support Security Forces Airmen of all ranks from within its own community.

While both programs seek to generate significant long-term positive performance effects, neither directly address the unique cognitive function limitations and training

needs of Security Forces' most at-risk population. Young adults have a decidedly greater need for neuro-tailored training and education than neurologically mature adults (Louw and Puentedura 2013, 31-32). Young adults are generally more neurologically primed than matured adults to improve from novel, targeted training that progresses over time (Strauch 2003, 21; Brown 2008).

Sophisticated human performance research applicable to improving law enforcement and combat decision-making processes is available. However, it is not uncommon for laboratory discoveries to enter clinical practice, not to mention military practice, after years or even decades. Research metanalysis indicates it takes an average of 17 years for 14 percent of new human-related scientific discoveries to become day-to-day clinical practice (Westfall, Mold, and Fagnan 2007, 403; Grant, Green, and Mason 2003, 220). It is up to Security Forces to seek out that information proactively and reduce the amount of time it takes to process, analyze, and apply research and laboratory discoveries. It is not known if and to what degree neuro-tailored training programming will have on the performance of young adults in authoritative roles. But results of neuroscience education in other fields is promising (Louw and Puentedura 2013, 31-52; Strauch 2003, 213-214).

This thesis examines two primary neuroscience education domains: neuroanatomy and physiological response. Understanding how the neurological domain integrates and interacts can improve first-term Security Forces Airmen's response in perceived high-threat situations, enhance disciplined initiative, and heighten commanders' employment of mission command principles.

Secondary Research Questions

To derive an answer to the primary research question, "Should Security Forces incorporate neuroscience education into training for first-term Airmen?" the researcher will explore answers to four secondary questions. Understanding the secondary questions provides a logical sequence of information and thought from neuroscience education fundamentals, to how they relate to Security Forces operations, and finally to their training implications and applications.

1. Are neuroanatomical and physiological response fundamentals relevant to Security Forces?
2. Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?
3. Does Security Forces possess organic capability to lead neuroscience education training?

Assumptions

Assumptions are statements the researcher believes to be true and are necessary to complete the planning and analysis of the study. The researcher identified the following assumptions for the purpose of this study:

1. The body of research knowledge regarding young adult judgment applications while under threat is in its infancy; however, sufficient data exists to establish relevance.
2. Neuroscience education research from well-studied but unrelated fields apply context to this thesis.

3. The researcher remained unbiased despite his familiarity with the cohort and subject matter.

Definition and Terms

The following definitions and terms provide greater clarity in the context of this thesis. The intent is to provide a common understanding of core concepts relevant to problem and research conceptualization.

Brain stem: Composed of the pons, medulla, basal ganglia and various divisions of the midbrain, brain stem structures are responsible for autonomic motor functions, such as breathing and heartrate (Doidge 2007, 150; O'Shea 2005, 53). The brain stem also mediates instinctive behaviors that such as aggression, fight, flight, or freeze, and hunger (Amthor 2012, 4874). The same structures of the human brain stem exist in reptile brains; hence, the brain stem is known metaphorically as the reptilian, or serpent, brain.

Comprehensive Airman Fitness (CAF): A holistic approach to fitness that includes fitness in the mental, physical, social, and spiritual domains (USAF 2014a, 13). In practical application, CAF provides an integrated framework that encompasses and integrates many cross-functional education and training efforts, activities, and programs. CAF structure follows mental, physical, social, and spiritual fitness lines of effort (USAF 2014a, 13).

Defender's Edge (DEFED): Security Forces-specific resilience initiative focused on enhancing performance, protection, and restoration of all members from a human performance optimization conceptual framework (USAF 2011, 3).

First-term Airman: Refers to enlisted Airmen currently fulfilling their initial enlistment term. Enlisted Airmen select an initial enlistment of four or six years. First-

term Security Forces Airmen typically, but not exclusively, range in age from 17 to 25 years old. Neuroscience education applications also apply to junior company grade and noncommissioned officers; however, this research study focuses on first-term Security Forces Airmen due to branch population density, average enlistment age, relative duty position responsibilities, and proximity to threats.

Frontal lobes: The human brain regions responsible for impulse control, long-term planning, mathematical calculations, and gratification postponement (Sapolsky 2010, 51; Gutman 2001, 257). As the brain's highest processing system, the two lobes act cooperatively as the brain's chief executive officer (CEO) of human behaviors and decision-making (Satterfield 2013, 15). To limit the amount of intricate language, "frontal lobes" is used to refer to all integrated frontal lobe subsystems including the primary motor cortex, premotor and supplementary motor areas, Broca's areas, dorsolateral pre-frontal cortex, pontine micturition center, anterior cingulate cortex, frontal eye fields, and orbitofrontal regions (Cobb 2016, 51).

Internal model: The brain's existing reality model based on previous sensory input, life experiences, cultural factors, and perception of social or work environments (figure 1) (Eagleman 2015, 747). Located in the thalamus, internal models filter high volume visual and other sensory information to decipher meaning from contextual situations (Cobb 2013a, 14; Eagleman 2015, 772; Moseley 2007, 171). Experience shapes internal modeling; internal modeling contributes to a predictive brain (Eagleman 2015, 759). The brain's prediction aptitude contributes to judgment and decision-making in contextual situations. The internal model creates an experience-expectant brain.

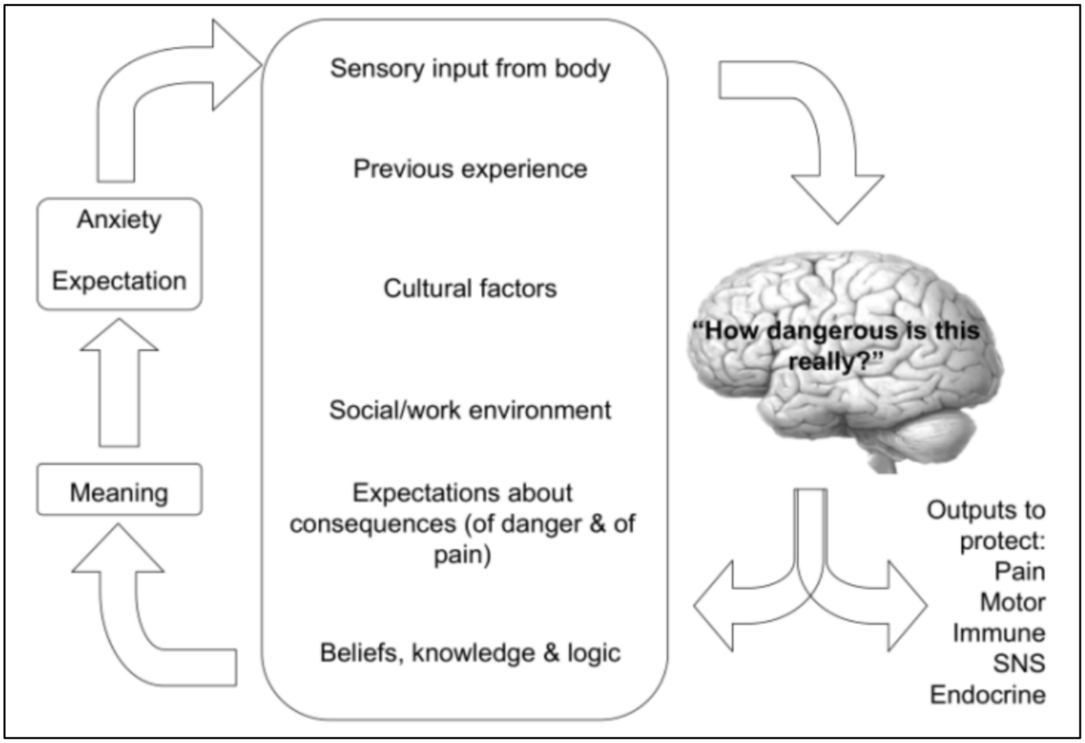

Figure 1. Internal Model Loop

Source: Lorimer Moseley, "Reconceptualising Pain According to Modern Pain Science," *Physical Therapy Reviews* 12, no. 3 (September 2007): 171.

Limbic system: The limbic system is a primitive brain construct comprised most notably of the thalamus, amygdala, and hippocampus structures (Siff 2004, 73). The researcher uses the term "limbic" instead of "temporal" to identify primitive brain areas associated with emotional processing (Steadman 2011-1, 12). Decades of research disproved the limbic notion of a consolidated system that regulates emotional control. However, the term "limbic" remains more pervasive in research literature than the term "temporal." Limbic is used in this thesis to ensure a more common description of the association between the thalamus, amygdala, and hippocampus structures.

Neuroscience education: The synthesis of relevant neuroanatomical and physiological response processes from various fields of study applied to a single field. Neuroscience refers to the scientific study of the nervous system. Brain science is a division of neuroscience (Pillay 2011, 3). In 2002, Dr. Lorimer Moseley introduced the neuroscience education concept as an alternative to pain medication to patients in his pioneering study (Louw and Puentedura 2013, 31; Moseley 2002).

Resilience: A complex, multi-dimensional construct through which individuals cope, withstand, recover, and grow in the face of stressors and changing demands (USAF 2014a, 14; Luthar, Cicchetti, and Becker 2000). Resilience is a state-of-mind and critical cognitive skill. It can be developed to assist an individual to positively adapt emotions and behavior during and after times of danger, psychological strains, hardships, and adversity (Connor 2006). There is a lack of universal acceptance of a definition for resilience (Wald et al. 2006, 23). Increasingly, scholarly research treats "resilience" distinctly different from "resiliency." Resiliency includes trait variables such as temperament and personality, and is therefore less malleable than state-of-mind or mood adaptations (Luthar, Cicchetti, and Becker 2000).

Startle reflex: A powerful indicator of how difficult or dangerous the nervous system perceives any given movement or situation (Cobb 2014, 17). In a tactical environment, startle can manifest in the forms of pain without injury, temporary cognitive dissonance, physical protective measures such as eyes closing, hands and arms protecting the face and head, legs bending to lower one's center of gravity, among many others (Cobb 2014, 17).

Threat: The term “threat” is used instead of “stress” to associate cognitive dissonance with an individual’s conscious or subconscious mental perception that a danger to one’s survival is present. Stress functions as either positive (eustress) or negative (distress) force; threat reflects a fear for mental, physical, or social survival and is not related to positive stress (Divine 2015, 41; McCollum and Broaddus 2016, 1). “High-threat” in the context of this study refers to the brain’s interpretation of situational input to determine an appropriate output. If one’s brain interprets sensory input as dangerous either physically, psychologically, or some combination of the two, it will protect itself in both overt and subtle ways (Juhan 1987, 308). Examples of physical manifestations of perceived threat include pain output, decreased motor control, and startle reflex. These indicate a prioritization of survival over performance (Louw and Puentedura 2013, 13). Threat perception is individual-specific; different internal model “lenses” affect how one’s brain interprets threat.

Limitations and Delimitations

Limitations are inherent restrictions in the study that the researcher cannot control or influence; they are acknowledged study design weak points. Delimitations are deliberate restrictive choices made by the researcher; they are self-imposed limitations to establish a refined scope of research.

A significant study limitation is the lack of empirical data and conclusive evidence to support the effect of neuroscience education when applied to young adults performing law enforcement functions. Regardless, the researcher draws parallels from more robust research found in therapeutic neuroscience education on pain patients, neuroanatomy studies, and sports psychology concepts. Additionally, research on

combat-related psychology has proliferated over the past decade due to wars in Iraq and Afghanistan (Kornguth, Steinburg, and Matthews 2010, 3; Creamer et al. 2003, 10). Combat-related research contains both direct and indirect implications for the intended cohort.

Advances in neuroscience technology over the past 25 years revolutionized the scientific community's comprehensive understanding of how the brain functions. Therefore, the first study delimitation is to limit referenced literature to within the past 25 years. Exceptions to this limitation include references to concepts developed more than 25 years ago but continue to maintain relevance.

The second study delimitation is to limit research to young adults. The term "young adult" refers to a military-aged person between 17 and 25 years old. While ages 17 through 19 technically define adolescence, "young adult" bridges adolescence with legal adulthood (World Health Organization 2016). Additionally, the use of "young adult" instead of "adolescence" insulates against unintended biases or derogatory connotations when referring to the affected cohort.

As a final delimitation, the thesis title, primary research question, and secondary research questions focus on USAF Security Forces branch. The focus on enlisted first-term Security Forces Airmen primarily stems from the researcher's first-hand familiarity with the target cohort. Further, Security Forces' DEFED program provides an excellent pre-established framework to exploit benefits from the proposed information. Security Forces can integrate or expand these research findings with greater ease than a career-field or law enforcement entity without a pre-existing resilience or performance-based program. Regardless, much of this research provides relevant context to enhancing

cognitive awareness and performance of young adults in other career fields, branches, or services, military or civilian, law enforcement-related or not.

Significance

Over the past thousand years, philosophers and scholars contemplated brain function but produced little empirical data. Today, popular culture interest in neuroscience research and resulting performance applications is growing exponentially. It is no wonder; technological advances are opening new frontiers into neuroscience.

The concept of neuroscience as a distinct research discipline emerged in the late 1950s and early 1960s (Cowen and Kandel 2001, 595). With the more recent introduction of brain imagery techniques, such as functional magnetic resonance imaging (fMRI), belief of what the neuroscience community thought it knew changed considerably. As information becomes more accessible than ever, general public interest in neuroscience continues to grow. Fueled by policy makers, media, and marketers, the realization brains are uniquely individual and the root of all change is quickly growing (Hirsh-Pasek and Golinkoff 2003, 20). Indeed, all human change, whether physical, structural, or mental, originates in the brain (Cobb 2011, 5).

Over the past 20 years, fiscal shortages coupled with dynamic mission evolutions resulted in two significant Security Forces changes: 1) a shift from specialists to generalists from the merging of Security and Police career paths into a single USAF specialty code; and 2) an incrementally greater reliance on junior enlisted members to assume roles traditionally held by more experienced, higher ranking Security Forces Airmen (Dorsey 1997).

Tomorrow's Security Forces Airmen will assume greater responsibly than ever before (Perkins 2016; James and Welsh 2015, 8-9; U.S. Army 2015, 2). Projected future operating concepts will present unprecedented cognitive challenges regarding decision-making, information management, and adaptive motor responses on the battlefield (Kornguth, Steinburg, and Matthews 2010, 167; Lopez 2016). Security Forces' reliance on young adults to perform progressively greater critical functions will continue to be strong in this evolving operating environment. Security Forces will need to evolve yet again to generate empowerment and disciplined initiative through smarter training and greater understanding of its core population. Currently, a 'gap' exists between what actionable neuroscience information is available and the operational and cultural integration of that material.

This thesis is significant because it is among the first efforts to begin to bridge the existing neuroscience education gaps underlying Security Forces operations. It seeks to integrate current and emerging neuroscience research with current operational considerations to increase young adult duty performance. This thesis is unique because it seeks to present and explain what current research reveals about the interrelations of neuroanatomical and physiological response factors affecting first-term Security Forces Airmen.

The researcher also seeks to explain how those neuroscience education factors impact decision-making in young adults, especially in perceived high-threat situations. This research study intends to be accessible for study and assimilation by Security Forces Airmen, Air Force leaders, and all sister-service and civilian partners alike. In short, the presented neurological research concepts provide new perspectives to develop improved

understanding and enhance the performance of all young adults operating in high-stress environments.

Finally, the information contributes directly to a practitioner's understanding of to human dimension concepts in actionable and simple ways. Information is of no use to the intended cohort or leaders if they cannot correctly interpret the data. Creating foundational awareness that young adult first-term Airmen, in general, have neuroanatomical limitations and instinctual reflexes inhibiting their ability to operate effectively to a greater extent than their older counterparts is the first step to developing improved risk reduction training methods.

Through continued research, understanding, and application, Security Forces has the potential to develop an already integrative DEFED resilience program into a comprehensive performance operating model. Thus, this thesis seeks to educate commanders, empower supervisors, and advance Security Forces training and culture to prepare for tomorrow's challenges in complex operating environments, both in garrison and deployed.

Chapter Summary

The next chapter explores current and scholarly literature in the areas of neuroanatomy and physiological responses to provide a framework for understanding how neuroscience can affect first-term Security Forces Airman responses in high-threat situations. Additionally, chapter 2 informs answers to the following secondary research questions:

1. Are neuroanatomical and physiological response fundamentals relevant to Security Forces?

2. Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?
3. Does Security Forces possess organic capability to lead neuroscience education training?

CHAPTER 2

LITERATURE REVIEW

> Everything you have ever felt or done in your life was due to brain function. At the most basic level, the intricate firing rates and patterns of your brain both determine who you have been and, more importantly, who you will become. All human change represents changes in that individual's nervous system. All that we are is brain-derived.
>
> — Dr. Eric W. Cobb

Chapter Introduction

This chapter presents a preliminary framework to outline relevant brain processes and considerations. Age-related neuroanatomical and physiological response processes assist in answering the primary research question, "Should Security Forces incorporate neuroscience education into training for first-term Airmen?"

Rather than dedicating large amounts of text describing environmental and contextual elements in anecdotal situations, the researcher seeks to provide synthesized data tailored to first-term Security Forces Airmen. However, the information is relevant to other law enforcement and combat-related branches, and civilian law enforcement agencies as well. The researcher presumes the reader has general awareness of law enforcement training fundamentals, inherent law enforcement or military leadership challenges, and interactions between them.

The subject matter regarding neuroscience and human performance is complex, contextual, and vast. The volume of neuroscience literature continues to increase in both breadth and depth across many fields. This chapter narrows the scope of research to two key areas relevant to understanding basic but often overlooked brain interactions.

Particularly, the research focuses on how biological design affects young adult responses in the moments leading up to and during high-threat scenario decision points. This permits a more precise discussion of the intrinsic risks and implications of relying on young adults during intense use-of-force situations.

Background Technical Information

The primary reason Security Forces Airmen should study brain function is to develop a personal awareness of how neuroanatomical factors influence contextual interpretation and performance output. An overview of fundamental neurological concepts is necessary to understand what unique factors place first-term Security Forces Airmen at risk of improper or inaccurate decision-making in use-of-force applications. Fundamental neurological concepts form the foundation from which the researcher will derive subsequent analysis.

Neuroanatomical Considerations

Intense social drives, constant searches for novel stimuli, attention seeking, risk taking, emotional instability, and impulsive tendencies typify young adult behavior (Greenfield 2015, 90; Casey, Getz, and Galvan 2008, 62). Conventional wisdom rationalizes characteristic young adult behavior as the brain steeping in an adolescent "hormone soup." Hormones do represent significant aspects of growth and influence of young adult behavior; however, specific hormone discussion lays outside the scope of this study. This thesis asserts the primary basis of irrational behavior lays in the neuroanatomical architecture of the brain itself.

The differences between the brain of a young adult and the brain of a fully matured adult are not obvious. All primary brain structures are physically present in both young and matured adults; but the system interactions are quite different. Less than 20 years ago, science accepted brain development to be complete by the end of childhood (Strauch 2003, 20). However, a revolution in neuroscience technology in the mid-1990s allowed neuroscientists to draw new conclusions beyond the brain's structural form—by observing the brain's neuronal interactions. Current research using fMRI techniques indicates human brain integration takes up to 26 years (Eagleman 2015, 187; Tsujimoto 2008, 358; Stuss and Knight 2002, 491). Even more surprising, emerging fMRI research suggests brain integration and development could continue beyond age 30 (Edwards 2010; Arnett 2004, 227; Howard-Jones 2010, 6).

FMRI is the leading method of observing brain function during task performance, thinking, or stress loading in the neuroscience field (Kornguth, Steinburg, and Matthews 2010, 3). A highly-sophisticated brain scanner, fMRI shows where the blood is flowing in the brain at any given time. More importantly, fMRI indicates which parts of the brain interact in specific physical or emotional situations (Gladwell 2005, 118). FMRI relies on the principle that the brain directs blood to areas used at specific points in time to supply oxygen, reflecting real-time neuronal function (Amthor 2012, 27). Since fMRI does not introduce radioactive agents into the observed subject, researchers can use it repeatedly to detect functioning capabilities of multiple areas at one time (Gladwell 2005, 118). Additionally, fMRI can track long-term collective changes between neurons in one's unique nervous system structure, or connectome, as it matures through age and experience (Amthor 2012 28; Seung 2013, 23).

Over the last decade, the National Institute of Mental Health conducted a major study using fMRI to examine how brain regions activate one another over the first 21 years of life (2011, 3). What was found is significant—the brain's connectivity and input patterns move from the bottom of the brain to the top; from the back of the brain to the front (National Institute of Mental Health 2011, 3; Jensen 2015, 37; Cobb 2014, 6). The National Institute of Mental Health's finding makes sense; the brain operates in the same fashion it evolved. The brain's bottom-to-top and back-to-front feeding pattern concept is significant to understanding how neural integration occurs and sensory information is processed (figure 2).

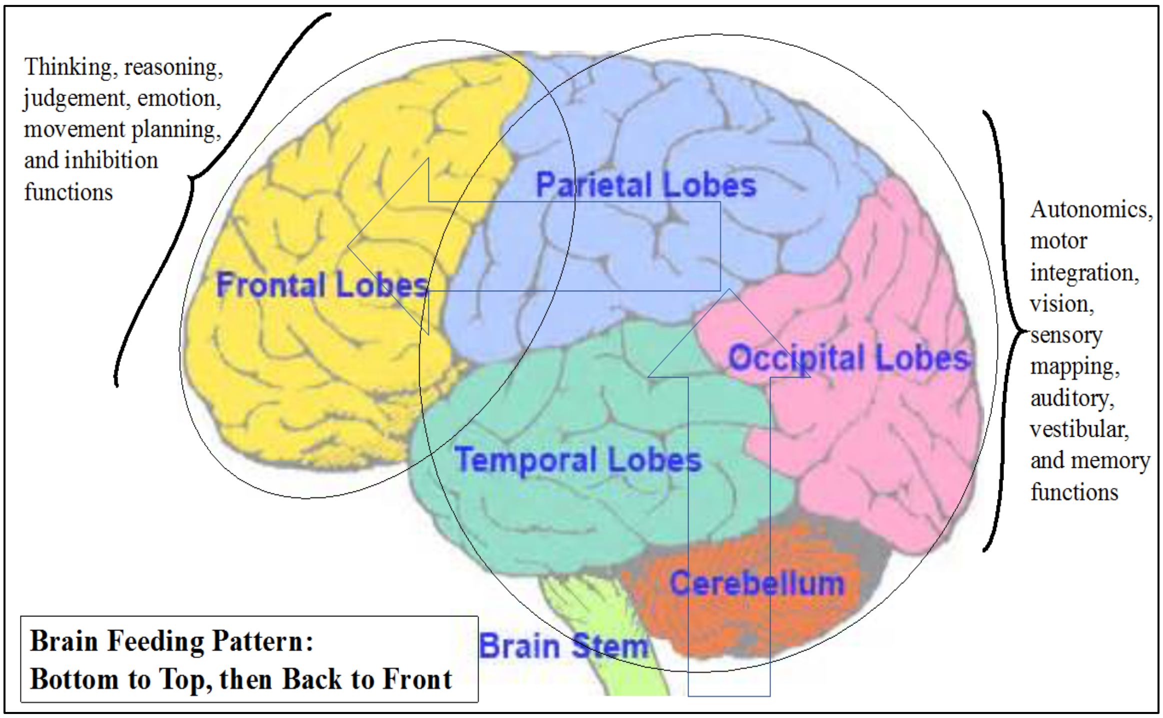

Figure 2. The Brain's Feeding Pattern

Source: Created by author. Data adapted from Eric Cobb, *Z-Health R-Phase Certification*, 5th ed. (Tempe AZ: Z-Health Performance Solutions, 2013), 5.

The brain operates as a “system of systems” model. As the young adult brain matures, systems increasingly integrate from evolutionarily primitive, autonomic brain systems to high-functioning cognitive systems. In general, young adult brains are only about 80 percent mature with the strongest connections rising from the lower-back, i.e., the brain stem (Siegel and Payne Bryson 2012, 41). The remaining 20 percent gap, located in the upper front where the neural integration is weakest, is crucial to responsible behaviors and goes a long way toward explaining why young adults, at times, behave in risky or irresponsible ways (Jensen 2015, 37). Indeed, the very last places to “link,” and areas of weakest integration until approximately age 26 or beyond, are the frontal lobes (Jensen 2015, 37; Sapolsky 2004, 229; Satterfield 2013, 25).

The number of unintegrated neurons, or gray matter, especially in the frontal lobes, peak at age 12 for males and 11 for females, then begin to decline (Giedd et al. 1999, 861; Strauch 2003, 20). As a young adult’s brain matures and accumulates experiences, neurons become increasingly insulated with a white fatty substance through a process called myelination (Casey et al. 2008, 4). Myelination, or white matter, increases integration between rear sensory and front motor cortices. Through one’s teenage years, the amount of myelin grows exponentially as compared to one’s pre-teen years (Strauch 2003, 53).

As neurons functionally integrate into an individual’s unique connectome, gray matter is pruned away or converted into white matter; thus, reducing the amount of free gray matter (Sowell et al. 1999, 860; National Institute of Mental Health 2011, 4; Seung 2013, 23). It is theorized these changes, along with other cellular processes occurring during this time, combine to increase the frontal cognitive system’s synaptic speed,

precision, and efficiency (Kornguth, Steinburg, and Matthews 2010, 88; Casey et al. 2008, 4; Hirsh-Pasek and Golinkoff 2003, 25). The results are not subtle; myelinated neurons deliver signals up to 100 times faster than non-myelinated neurons (Giedd 2009). The mechanisms governing the rise and decline of gray matter are not completely understood; however, the integrative myelination process can be clearly observed over time using fMRI techniques (figure 3).

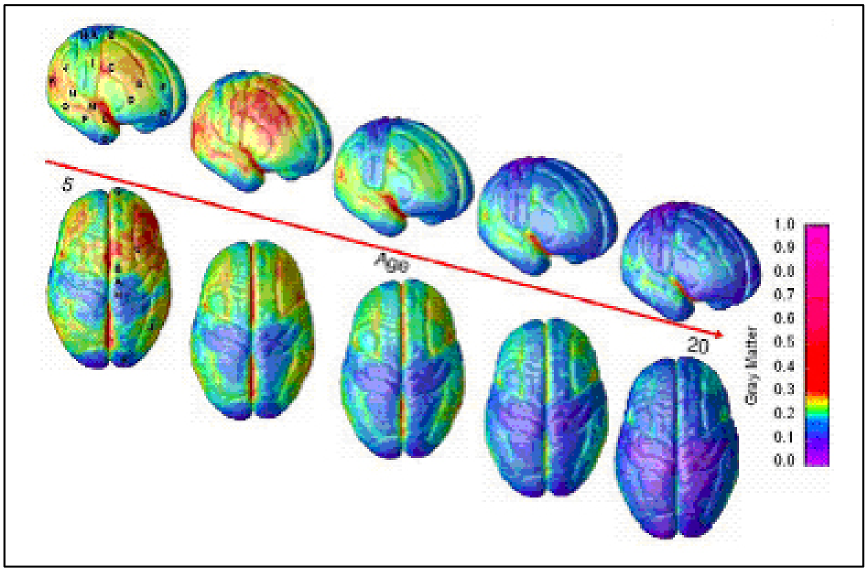

Figure 3. Maturation and Myelination of the Brain

Source: N. Gogtay, Jay Giedd, Leslie Lusk, Kiralee Hayashi, Deanna Greenstein, A. Catherine Vaituzis, Tom Nugent III, David Herman, Liv Clasen, Arthur Toga, Judith Rapoport, and Paul Thompson, "Dynamic Mapping of Human Cortical Development During Childhood through Early Adulthood," *Proceedings of the National Academy of Sciences* 101, no. 21 (May 2004): 8177.

The frontal lobes' significance to the primary research question lies in their regulation of the brain's executive functioning. As the brain's highest processing system, the frontal lobes act together as the brain's CEO for characteristic human behaviors and

decision-making (Satterfield 2013, 15). The frontal lobes coordinate or inhibit other parts of the brain, help the mind focus on the main point of a situation, form goals, and enable critical and creative thinking processes (Doidge 2007, 274).

Under stress, a well-integrated brain unlocks frontal lobe resources to assess perceived threats from a rational perspective. Weak front brain myelination in young adults presents frontal lobes that are functionally less capable of rationally evaluating threats as quickly or to the level capable of their adult counterparts (Greenfield 2015, 88; Jensen 2015, 269). The result is a brain that may be structurally powerless to anticipate potential consequences of actions (Restak 2001, 49). It also impacts production of critically thoughtful and agile decisions under tight time constraints characteristic of law enforcement and combat situations (Restak 2001, 49).

Temple University psychologist Laurence Steinberg’s neurological system analysis provides further perspective to young adult frontal lobe limitations (Steinberg 2010, 216). Steinberg’s analysis centered around two separate neurological systems: the incentive processing system and the cognitive control system (Steinberg 2010, 216). The incentive processing system is responsible for the things that are characteristically young adult: emotionality, social attentiveness, and thrill seeking (Eagleman 2015, 187; Tough 2012, 21). The cognitive control system is distinctively mature adult; it governs irresponsible behavior by enabling self-regulation (Steinberg 2010, 217). The problem lays in when the two systems develop.

The incentive processing system fully develops in early adolescence; the cognitive control system does not fully come online until one reaches their mid-twenties (Tough, 2012, 21). It is apparent there is direct correlation between frontal lobe

myelination and how well one can self-regulate behavior. When young adults encounter particularly threatening situations, they react based on the mental processing means available. Unfortunately, these early hardwired components, collectively known as the limbic system, are predisposed to operate from survival rather than performance aspects of decision-making (Cobb 2013b, 5).

At its most basic level, the brain operates with an iterative input-interpretation-output feedback loop (Bush 2015). When the brain encounters a threatening input, i.e., a subject's active or passive non-compliance, or interprets an input as threatening, i.e., hostile language or public speaking, the brain creates physiological changes and motor outputs. The resulting outputs and duration are largely dependent upon one's internal model, level of experience with the current situation, emotional state, and ability to draw upon frontal lobe resources.

Physiological Responses to Threat

While the frontal lobes represent the hallmark of all neuroanatomical evolution, it is not a primal autonomous system; it takes time to develop and function optimally. In the 26 years it takes for the frontal lobes to come online completely, the brain relies on two primary systems to ensure survival during high-threat situations: the limbic system and the autonomic nervous system (ANS) (Hampden-Turner 1981, 80; Gutman 2001, 4). In general, the more mature and globally-myelinated the brain is, the greater the regulation of the ANS and limbic system (Dekoven-Fishbane 2007, 398). ANS and limbic system regulation improve the probability to make appropriate decisions faster in high-threat situations (Grossman 2009, 8; Restak 2001, 49). Conversely, young adults who lack experience and full ability to inhibit ANS and limbic response are prone to be impulsive,

unintentional, or hesitant when faced with high-threat decisions (Grossman 2009, 5; Restak 2009, 18).

The central nervous system, i.e., the brain and spinal cord, and the peripheral nervous system comprise one's nervous system (figure 4) (Gutman 2001, 4). The ANS is one of two primary peripheral nervous system components; it consists of two major subsystems: the parasympathetic nervous system (PNS) and sympathetic nervous system (SNS) (Gutman 2001, 4; Grossman and Christensen 2008, 14). As the term "autonomic" suggests, the ANS reflexively performs tasks that most neither think about nor have much control over (Amthor 2012, 1267).

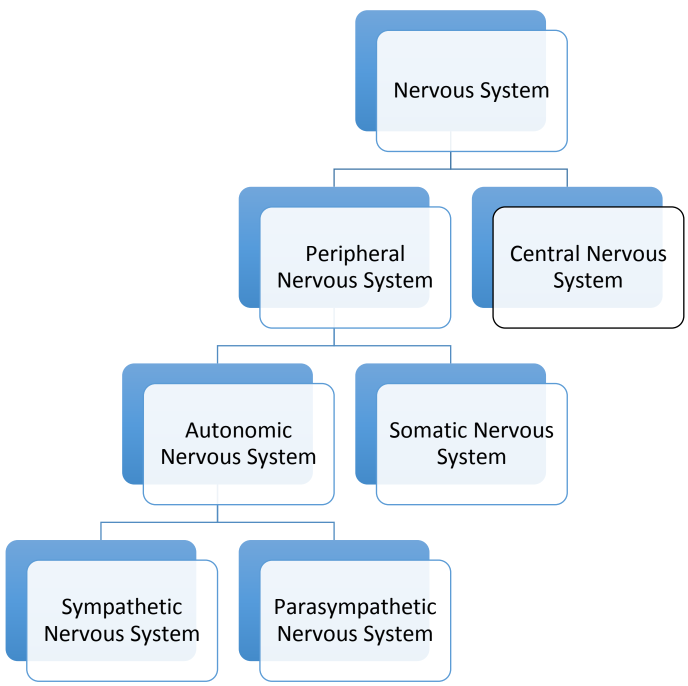

Figure 4. Nervous System Hierarchy

Source: Created by author. Data adapted from Sandra Blakeslee and Matthew Blakeslee, *The Body Has a Mind of Its Own* (New York: Random House, 2007), 183.

Together the PNS and SNS operate in a mutually-supporting iterative fashion to maintain a state of homeostasis. Under normal operant conditions, the PNS is the dominant function. The PNS regulates heart rate, breathing, digestion, and many other functions that are essential for survival but often considered as afterthoughts (Ratey 2001, 232). Exposures to threat disrupt normal PNS function through SNS activation.

The SNS prepares the body for immediate fight, flight, or freeze at the expense of regulating body functions. Chronic or prolonged SNS activation, i.e., persistent perceived threat, negatively impacts normal bodily functions such as growth and healing processes (Amthor 2012, 1267; Doidge 2016, 111). The extremity to which the SNS activates depends on the level of perceived threat. As a primal survival mechanism, SNS activation can drive heart rate from 70 beats per minute to over 200 beats per minute in less than one second. Rapid SNS response enables the body to take appropriate emergency measures (Ryan and Evans 2000, 14).

While individual-dependent, under conditions of extreme threat the SNS can cause catastrophic failures in the visual and memory centers, executive functioning, and motor control as described in figure 5 (Artwohl 2002, 18; Siddle 1995, 89; Grossman and Christensen 2008, 31). In short, extreme stress creates mind-blindness (Gladwell 2005, 229). SNS effects last as long as the perceived threat exists, until catastrophic failure occurs, or PNS reactivation (Ryan and Evans 2000, 15).

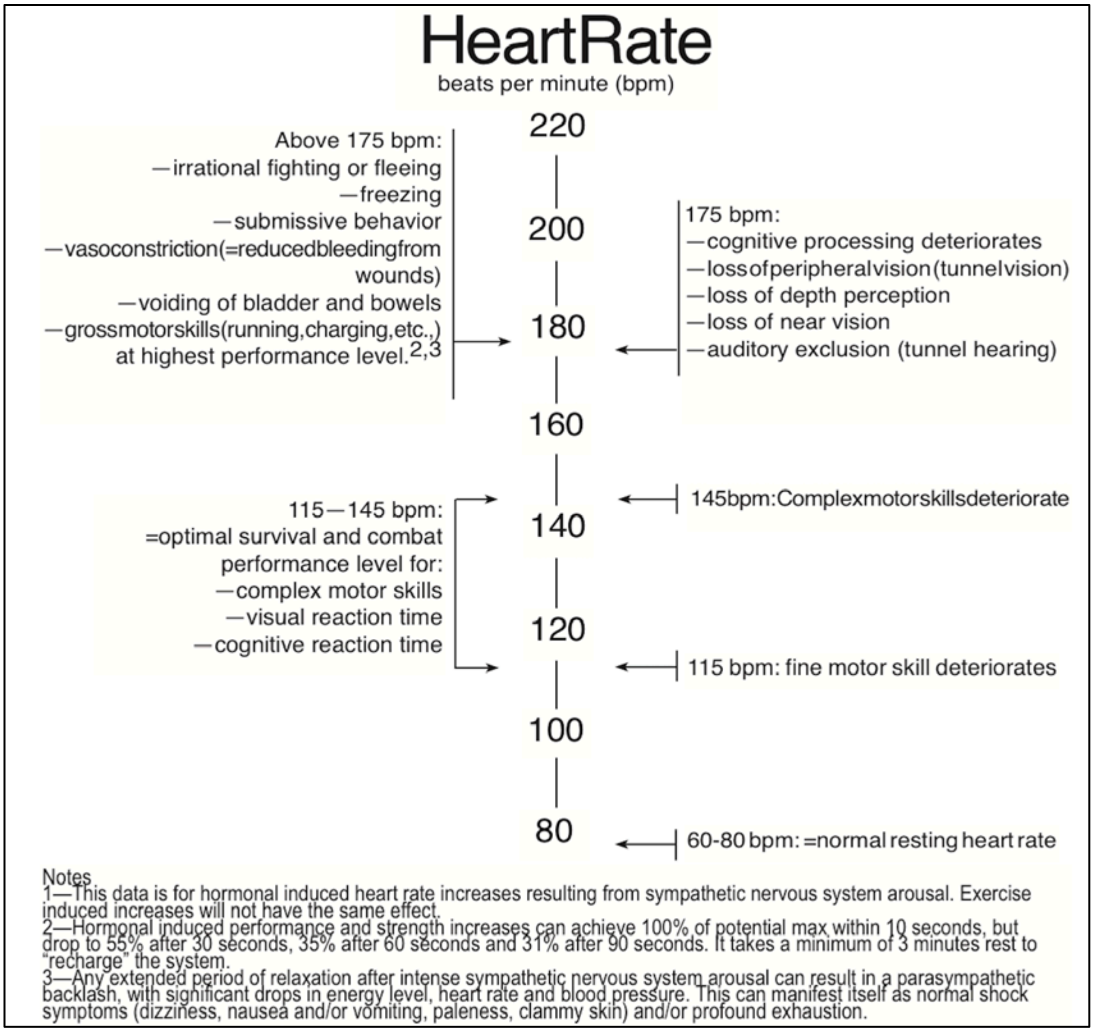

Figure 5. Effects of Hormonal or Fear Induced Heart Rate Increase

Source: David A. Grossman and Loren W. Christensen, *On Combat: The Psychology and Physiology of Deadly Conflict in War and in Peace*, 3rd ed. (United States: Warrior Science Publications, 2008), 31.

The activation of the SNS is largely dependent on how the limbic system's thalamus processes the threat stimuli. The thalamus acts as a sensory input gatekeeper, directing where information processing occurs to create an output. The thalamus directs sensory inputs in two ways: the low road or high road (LeDoux 1996, 164). The differences between the two "roads" are rate-of-speed and interpretation clarity. The low

road is a raw, unfiltered direct input to the amygdala; the high road also feeds into the amygdala, but with clearer, more refined information input.

The direct thalamic-limbic path is the brain's quickest, immediate path to create an output. The purpose of this primitive survival pathway is to begin generating a response to potentially threatening stimuli before the brain fully understands what is happening (LeDoux 1996, 164; Kresinger Sr. 2016; Seigel and Bryson 2012, 39). A classic example of low road processing involves walking on a path and seeing a snake in peripheral vision. The natural reaction is to jump back with a startle reflex. Only after additional cognitive processing does one realize the "snake" was nothing more than a harmless stick (LeDoux 1996, 168). The low road is an evolutionary protective mechanism. The thalamic-limbic shortcut allows the brain to generate fight, flight, or freeze motor responses in less than 12 milliseconds (Cobb 2012, 46).

The thalamic-limbic pathway operationalizes at a very young age and is very useful in dangerous situations to ensure survival. Based on an individual's internal model, the thalamic-limbic path signals the amygdala to "sound the alarm" and mobilize sufficient SNS functions (Cobb 2012, 46; Louw and Puentedura 2013, 75; Seigel and Bryson 2012, 42). Unfortunately, the thalamic-limbic adaptive response is not always appropriate. Positions of authority and public trust require self-regulation, even in the face of danger, as an overarching professional expectation. Overresponse can result in both internal and external hyper-stimulation and lead to unintended consequences (Ratey 2001, 232). The frontal lobes prevent an unintentional or inappropriate response—if frontal lobe structures are accessible in time (figure 6) (LeDoux 1996, 164).

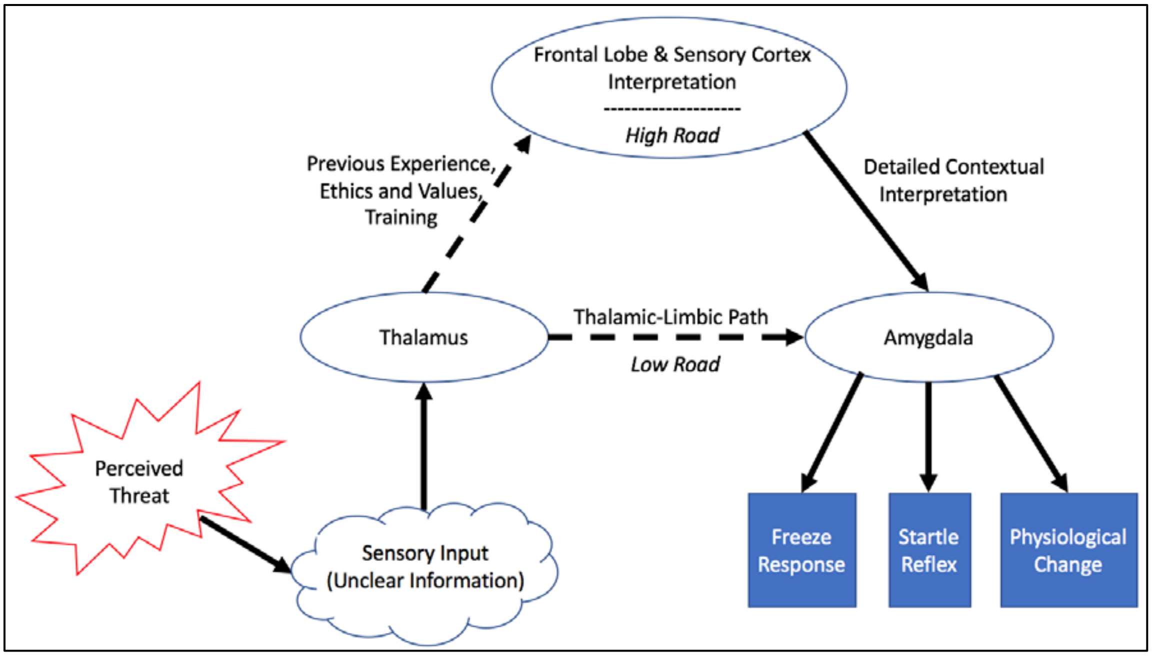

Figure 6. The High Road/Low Road Response

Source: Created by author. Data adapted from Joseph LeDoux, *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (New York: Touchstone, 1996), 164; David Eagleman, *The Brain: The Story of You* (New York: Pantheon Books, 2007), Kindle 772; Ronald S. Chong, "Towards a Model of Fear in SOAR," (SOAR Workshop XIV, May 22), 4.

The high road offers the brain an advanced evolutionary alternative to thoughtless reflexive action. The high road applies cognitive processing filters to produce significantly more accurate and detailed information but produces a much slower motor output response (Cobb 2012, 46). The frontal lobes and sensory cortex will send high road information to the amygdala to generate a response, but up to three times slower than the low road (Cobb 2012, 46). It is not surprising that a connection between frontal lobe development and the low road/high road paradigm exists.

Research suggests there is a gradual shift from low road to high road processing as the young adult brain matures and gains experience (Ratey 2001, 234). The default frontal lobe processing method is a primary delineator between mature adults and young adults; it explains why young adults often struggle to regulate emotion, especially in crisis situations (Jensen 2015, 171). The good news is the brain is not fixed. Neuroplasticity, or brain adaptability, is the rule not the exception (Doidge 2007, 97; Firth 2011, 5; Eagleman 2015, 2278).

Chapter Summary

The review of relevant foundational neuroscience literature provides insight and context to the secondary research questions. Chapter 2 presents an overview and synthesis of neuroanatomical and physiological response fundamentals relevant to the research topic. The next chapter, chapter 3, presents the research methodology used to assess neuroscience implications for first-term Security Forces Airmen responses in perceived high-threat situations.

A stepwise approach is used to answer the secondary research questions. Secondary question results establish the foundation to answer the primary research question, "Should Security Forces incorporate neuroscience education into training for first-term Airmen?" Chapter 4 provides analysis of the secondary questions:

1. Are neuroanatomical and physiological response fundamentals relevant to Security Forces?
2. Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?

3. Does Security Forces possess organic capability to lead neuroscience education training?

CHAPTER 3

RESEARCH METHODOLOGY

> You must all try to alleviate confusion, but in doing so be careful not to create more. Ours is not the job of actually commanding, but of assisting.
>
> — Norman "Dutch" Cota

Chapter Introduction

This study seeks to increase awareness regarding inherent risks associated with young adult decision-making during high-threat use-of-force situations. The output of this qualitative study is a substantive hypothesis that emerges from, or is "grounded" in, the data (Merriam and Tisdell 2016, 31). The purpose of this thesis is to present a substantive hypothesis that first-term Security Forces Airmen require specific training based upon research in two major neuroscience elements: neuroanatomical considerations and physiological responses to threat (Creswell 2007, 106).

The purpose of this chapter is to describe the research methodology. The secondary questions directly contribute to answering the primary research question, "Should Security Forces incorporate neuroscience education into training for first-term Airmen?" This chapter frames how programmatic data sources are used and explains the analysis method (Stake 1995, 4).

The following secondary questions guided this study's approach:

1. Are neuroanatomical and physiological response fundamentals relevant to Security Forces?
2. Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?

3. Does Security Forces possess organic capability to lead neuroscience education training?

Overview

The researcher executed basic qualitative research using grounded theory as the method (Merriam and Tisdell 2016, 25). Rather than relying on numerical data to create a statistical analysis, as in quantitative research, I sought to gather data to explore specific variable of interest using an inductive approach (Merriam and Tisdell 2006, 5-17; Creswell 2007, 66). Thus, a qualitative approach is the appropriate foundation for the nature of this study's research problem.

The primary goal of a qualitative research is to uncover and interpret meaning of a phenomenon (Merriam and Tisdell, 2016, 24-25; Creswell 2007, 36-37). In this case, the phenomenon explored is how neurological limitations affect interpretation and response of first-term Security Forces Airmen in high-threat use-of-force situations. As with all research methodologies, qualitative research has strengths and limitations; it is debatable if its strengths outweigh its limitations depending on its field of study applications (Merriam 1998, 41; Beins 2009, 342).

The grounded theory research design relies on the researcher as the primary instrument of data collection and analysis (Merriam and Tisdell 2016, 31). For purposes of this thesis, grounded theory is defined as theory generated from data systematically obtained through the constant comparative method (Creswell 2007, 106; Conrad 1978, 101). Constant comparison is an iterative process. It consists of cross-reviewing data to develop an understanding of information, then adapting the evolving theory to fill in the gaps and elaborate on how a process works (Creswell 2007, 85). Crucial to this step is

note-taking. The constant comparison method allowed the researcher to generate a substantive-level hypothesis from the research process (Creswell 2007, 42).

Substantive-level hypothesis development results in two outcomes. First, it allows subsequent testing for empirical verification with quantitative data to determine if it can be generalized to a sample and population. Second, the substantive-level hypothesis development itself may be the goal of the research. My intent is to allow the analytic, substantive-level hypothesis to emerge and serve as a basis for future quantitative and qualitative research (Creswell 2013, 83).

Evaluation Criteria

The nature of the primary and secondary research questions prohibits definitive "yes" or "no" responses. The use of the word "should" as a qualifier in the primary research question indicates contextual elements exist that prevent answering the question in an absolute form. "Should" infers a moral duty or propriety which implies obligation, duty, or expediency (Smith 2016, 25; Merriam-Webster 2016). In this thesis, "should" seeks to determine if Security Forces has an obligation to provide specific, neuroscience education training and, if so, to what degree. Evaluation criteria will assist in providing clarification to gray areas and provide an assessment tool to reevaluate program needs as variables change in the future.

The response evaluation criteria will determine if Security Forces should incorporate neuroscience education to young adult first-term Airmen by examining the sufficiency of each measure applied. Table 1 depicts the measurement criteria of the secondary questions. Aggregated data will infer if Security Forces should or should not provide neuroscience education to its Airmen. First, each criterion is addressed

individually and then aggregated in chapter 4. Chapter 5 discusses “gray areas” such as the level of application, implementation timeline, cultural implications, and operational approach.

Table 1. Response Evaluation Criteria

Secondary Questions Being Evaluated	No	Qualified Yes	Yes
1) Are neuroanatomical and physiological response fundamentals relevant to Security Forces?			
2) Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?			
3) Does Security Forces possess organic capability to lead neuroscience education training?			

Source: Created by author.

“No,” “Qualified Yes” and “Yes” determine the sufficiency of the secondary questions. The criteria “Yes” and “No” indicate both researcher and research conclude sufficient evidence supports a declarative response. “Qualified Yes” suggests the presence of applicable evidence, but not enough to be conclusive. Determination and designation of criteria rely on the subjectivity of the researcher. Thus, evaluation criteria are susceptible to the researcher’s bias and internal model.

Stepwise Research Methodology

The researcher developed a seven-step research methodology roadmap based on Morgan and Garmon Bibb's population-based assessment approach (figure 7). The researcher started with a broad conceptual design to develop the primary research question. Subsequent steps refined information and established conditions for substantive hypothesis development. The following describes the specific steps used throughout this research study to implement the grounded theory methodology:

Step 1: The first step of this research design is to conduct a literature review to answer the question, "Are neuroanatomical and physiological response fundamentals that comprise neuroscience education relevant to Security Forces?" This step will be completed in chapter 2.

Step 2: The second step in the research design is to analyze the second secondary question against the evaluation criterion: "Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?" This step will be completed in chapter 4.

Step 3: The third step is to analyze the evaluation criterion: "Does Security Forces possess organic capability to lead neuroscience education training?" This step will be completed in chapter 4.

Step 4: The fourth step is to aggregate the findings. Aggregation will answer the primary research question and allow the development of propositions that describe the interrelations between the study's categories (Creswell 2007, 65). This step will be completed in chapter 4.

Step 5: The last step in the research design is to present conclusions and recommendations for future research. This step will be completed in chapter 5.

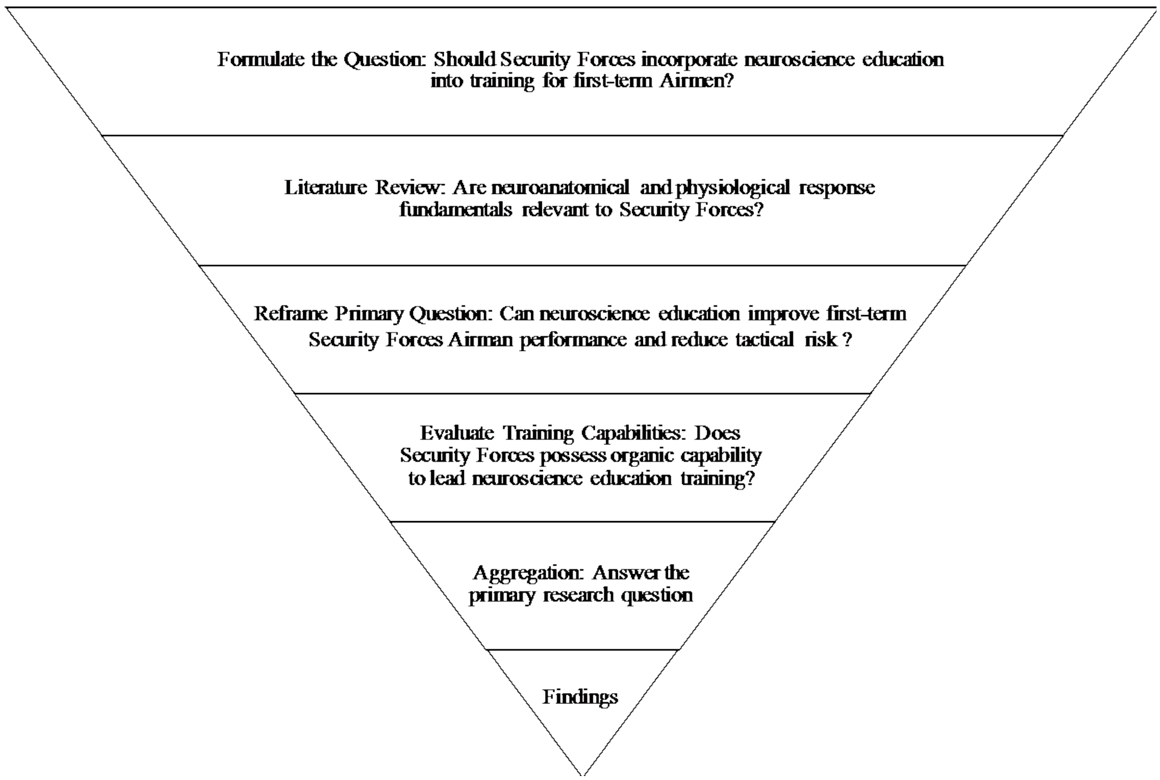

Figure 7. Stepwise Methodology Roadmap

Source: Created by author. Data adapted from Brenda J. Morgan, and Sandra C. Garmon Bibb, "Assessment of Military Population-Based Psychological Resilience Programs," *Military Medicine* 176, no. 9 (September 2011): 977.

Threats to Validity and Biases

This research study contains factors potentially threatening to its validity and conclusions. Before presenting data and conducting analysis it is essential that I acknowledge and mitigate known threats to validity and biases. Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the

researcher is attempting to measure (Howell et al. 2012; Wallman 2011, 368). Threats to validity include anything that may affect the accuracy of the research and soundness of the conclusion (Smith 2015, 28). Researcher bias can affect the validity and reliability of findings by favoring a single point of view over others based on personal beliefs, questions, and reporting.

My formal education background includes undergraduate and graduate degrees in Criminal Justice, a Graduate Certificate in Organizational Leadership, and a current American Society for Industrial Security Certified Protection Professional certification. Additionally, my professional experience includes seven years as a Security Forces operations officer followed by two years as a commander of a medium-sized Security Forces squadron. As a Security Forces squadron commander, I oversaw the administration of the annual training plan, DEFED, and CAF programs for 172 civilian and military personnel.

My perspective is that of a former and future Security Forces commander. Thus, I have preconceived ideas regarding the application and program designs of DEFED and CAF. Additionally, since I have held one formal command position, my direct involvement as an administrator of organizational DEFED and CAF implementation is anecdotal. However, as a career Security Forces officer, my experience as both a program participant and co-facilitator includes direct involvement with seven organizational programs. My experience as both an administrator and participant enable me a multi-dimensional perspective that assist in balancing unintentional biases.

My lack of formal undergraduate and graduate education in a neuroscience field is a research threat. The potential exists that information will be misinterpreted or

subjectively interpreted. However, I developed neuroscience background expertise over the past six years through rigorous self-study and graduate-level continuing education through Z-Health Performance Solutions' live instruction courses. Z-Health is a private educational company based on up-to-date research across many domains. It specializes in producing brain-based approaches to fitness and performance domains. I maintain currency in R- and I-Phase trainer qualifications through Z-Health's certification program requirements. I self-funded my Z-Health credentials for personal educational purposes. I am neither compensated by nor financially indebted to Z-Health or any other private entity in any way; there are no known conflicts of interest between this study and me.

Grounded theory centers on the researcher's skill, integrity, and biases; it is interpretive. It is possible to ignore viable explanations because they do not fit with the researcher's theoretical position (Beins 2009, 342). Further grounded theory limitations include possible issues of reliability, validity, and generalizability (Merriam 1998, 43). The identified grounded theory limitations are linked to the researcher's biases and, potentially, ethics.

I acknowledge the presence of additional biases intrinsic to qualitative research that potentially affect the quality of this study. Potential threats to research include my ability to evaluate information, document access limitations, personal bias in assessment adjudication, selection bias, and susceptibility to drawing anecdotal conclusions (Davies 2007, 237). Document access limitations inhibit my ability to consider and apply all materials to complete a fully comprehensive study. Document access limitations also affect selection bias. Since publicly accessible DEFED-centric documents and research

data are scarce, important information may be unavailable for recommendation or conclusion considerations.

Known as confirmation bias, I am vulnerable to an unconscious case-building process (Nickerson 1998, 175). The researcher is the primary instrument for data collection and analysis (Merriam and Tisdell 2016, 16). Since all observations and analyses filter through one's internal model, biases are natural occurrences (Merriam 1998, 21). I am personally familiar with the discussed resilience and performance programs. I am not entirely objective to the predicated outcomes and answers to the primary and secondary questions.

In addition to those already mentioned, I employed several validation strategies to mitigate known biases. The first is to keep the reader aware of any biases or assumptions that may impact the inquiry (Creswell 2007, 208). Additionally, I utilized external audits to ensure objectivity. Four primary external auditors, each specialized in unique neuroscience and cultural perspectives, validated my findings. Collectively, each auditor independently analyzed the study and examined whether or not the data supported the findings, interpretations, and conclusions provided (Creswell 2007, 209).

I also employed periodic peer reviews to obtain a "devil's advocate" point of view. Peer evaluators possessed diverse backgrounds from both inside the Security Forces career field and from unique outside perspectives. Furthermore, I applied source triangulation to particularly technical information throughout the study to corroborate evidence with multiple sources (Creswell 2007, 208).

Chapter Summary

This chapter outlines my intent to employ a qualitative grounded theory approach. Using this approach, I will seek to understand and build substantive hypothesis on why young adult neuroanatomy is worthy of further study by the Security Forces branch. The analysis of relational factors between applicable training programs, research derived externally from Security Forces, and cultural factors will enable exploration of further applications of neuroscience education concepts both in training and in operational contexts. Chapter 4 provides data, analysis, and evaluation of the secondary research questions that will derive an answer to the primary research question, “Should Security Forces incorporate neuroscience education into training for first-term Airmen?”

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

> Research is to see what everybody else has seen and to think what nobody else has thought.
>
> — Albert Szent-Gyorgyi

Chapter Introduction

The primary reason Security Forces Airmen and leaders should study young adult brain function is to understand how neuroanatomical factors influence performance outputs and resultant risks. This chapter presents and analyzes data using the stepwise approach outlined in chapter 3. The literature review and applied research methodology answer the secondary research questions which collectively form the foundation to answer "Should Security Forces incorporate neuroscience education into training for first-term Airmen?"

Overview of Literature Review

The literature review highlighted several neuroscience-based factors relevant to law enforcement and military entities. The brain's experiential memory and maturation correlates to how individuals exercise judgment and decision-making. Young adults face greater difficulties in accessing the frontal lobes' full cognitive processing capabilities than compared with their mature adult counterparts. Threatening situations require both cognitive development and internal model experience to interpret meaning. Brain maturation is also responsible for how young adults respond in exigent circumstances.

Pre-wired survival responses predispose young adults to reactionary “low road” systems. Default biological threat processing systems produce responses, but those responses are unpredictable. The default system response depends more on the young adult’s threat interpretation than rational thought; thus, response is highly individualistic. The resulting unpredictability underlies the performance output and risk concerns during use-of-force responses.

Natural ingrained responses create perceptual distortions and create potential use-of-force situations where officer response does not match the “reasonableness” of the subject’s actions. Brain architecture is a primary influence to how one responds to threat. But it is malleable, trainable, and capable of specific adaption to imposed demands. Young adults cannot “force” brain maturation to occur, but they can influence internal model development and develop specific myelination pathways. In short, young adults can accelerate cognitive parity with matured counterparts through deliberate individual and organizational training efforts.

The researcher designed the literature review to present neurological factors that are not accessible by young adults directly. The researcher does not intend to correlate ingrained responses with young adult intelligence. Rather, performance output and operational risk concerns result from the maturity and the brain’s natural response manifestations, not the young adult himself.

This section outlined broad literature review concepts implicit to understanding the study’s contextual framework. The next section, Step One, clarifies specific neuroscience concepts and resulting implications. Step One answers the secondary

question, “Are neuroanatomical and physiological response fundamentals that comprise neuroscience education relevant to Security Forces?”

Step One: Applicability

Although the literature review merely scratches the surface of the existing body of knowledge regarding neuroscience education, the findings are promising to understand the young adult condition. The foundational premise is young adults entering Security Forces have not reached full neuroanatomical maturation; upon enlistment, they are not ready for the cognitive rigors intrinsic to law enforcement or combat.

The neuroanatomical implications of a brain which has yet to reach full maturity are significant. A young adult’s inability to rely on frontal lobe resources affects the production of critically thoughtful and agile decisions under tight time constraints (Restak 2001, 49). These characteristics are common in law enforcement and combat situations. Inability to access frontal lobe resources also goes a long way toward explaining why young adults may behave in risky or irresponsible ways (Jensen 2015, 37).

Two primary factors form the premise basis: neuroanatomical considerations and physiological responses to threat. A broad body of knowledge indicates the brain progressively develops both in systems integration and speed of synaptic firing over time, peaking at age 26 or beyond (Eagleman 2015, 187; Tsujimoto 2008, 358; Stuss and Knight 2002, 491; Edwards 2010; Arnett 2004, 227). During perceived high threat situations, young adults are less able to access the frontal lobes’ full potential and produce rational assessment and response capability speeds than mature adults. The result

is a brain that may be functionally powerless to anticipate potential consequences of actions (Restak 2001, 49).

Neuroanatomical considerations also correlate to impaired physiological responses to threat. The brain relies on two primary rapid-response survival systems during high-threat situations: the limbic system and ANS (Hampden-Turner 1981, 80; Gutman 2001, 4). Mature brains regulate limbic system and ANS responses to produce contextual, appropriate decisions while experiencing high threat stimuli (Grossman 2009, 8; Restak 2001, 49). Conversely, young adults who lack experience and full ability to inhibit ANS and limbic response are prone to be impulsive, unintentional, or hesitant when faced with high-threat decisions (Grossman 2009, 5; Restak 2009, 18).

Neuroscience education opponents will point to the success of Security Forces' traditionalistic history. Security Forces has employed young adults as a core population since its Air Police roots without "need" for specialized neuroscience education. It is true; young adults naturally follow cognitive development processes as they mature. Thinking patterns change due to military training and organizational culture. Many young adults reliably transform into mid- and senior-level leaders at a predictable trajectory. But environmental and operational outlooks are changing. Current operational expectations are more demanding than ever; future tactical-level operating concepts will demand even more.

Tactical-level operations are time sensitive and rapidly evolving. USAF fighter pilot Colonel (retired) John Boyd's observe, orient, decide, act loop reflects the types of cognitive challenges faced by Security Forces' tactical-level operations. Boyd developed his theory as a model to expedite decision-making in rapidly evolving situations. Boyd

asserts the key to victory is to create situations wherein one can make appropriate decisions faster than their opponent (Cobb 2014, 16). The one who consistently cycles through the 'observe, orient, decide, and act loop' the fastest gains a tremendous advantage. A primary young adult problem is the inability to cycle through the loop with cognitive speed and accuracy consistently.

When young adults enter military service, most do not possess the cognitive skills to think critically. They are not self-directed learners able to take responsibility for their personal development. It is not a reflection on young adults' intelligence; it is a manifestation of their biological and psychological maturity (Walker and Bonnot 2016, 3). While acknowledging the successes of the past, Security Forces leaders must also recognize the present and future offer organizational, personnel, and cognitive challenges not faced in the past.

Criterion 1: Are neuroanatomical and physiological response fundamentals that comprise neuroscience education relevant to Security Forces? The literature review clearly indicates neuroscience education concepts are relevant to improving contextual understanding, judgment speed, and decision-making abilities while under stress. Neuroanatomical limitations improve over time; however, neuroscience education offers novel concepts to accelerate the efficiency and effectiveness of young adults in tactical roles. Improved cognitive abilities will also contribute to mitigating branch-wide operational risk.

Table 2. Step One: Applicability Criteria

Secondary Question Being Evaluated	No	Qualified Yes	Yes
1) Are neuroanatomical and physiological response fundamentals relevant to Security Forces?			X

Source: Created by author.

The next section, Step Two, presents expected outcomes of neuroscience education processes. No known reliable research studying the effects of neuroscience education on young adults in law enforcement or combat roles exists. Therefore, inferences are made from cross-functional fields of study. Step Two of this research design answers the secondary question, "Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?"

Step Two: Likelihood of Improvement

Education is the foundation for improving first-term Security Forces Airman performance. As Security Forces endures decreased manning and resources, core responsibilities remain the same. While not all squadrons are equally affected, many face an 80 percent assigned-to-authorized manning rates. The resultant "maintain with less" reality reflects the state of the Department of Defense's fiscal limitations. The defense budget's unpredictable nature emphasizes the importance of cultivating an educated force more than ever.

Both the USAF and Security Forces continuously emphasize the importance of obtaining higher education to junior members. It is no wonder; research indicating the

effects higher education has on cognitive processing and performance is well established. In one metanalysis, researchers found significant correlations between education and most measures of civilian law enforcement performance (Smith and Aamodt 1997, 52). Performance measures included overall performance, communication skills, response to new training, commitment to the organization, and most importantly, decision-making and judgment. However, possessing higher education is not enough to increase duty performance in and of itself. Education must overlap with contextual application and experiential learning to derive the greatest benefits.

Education to build specific adaptation to imposed demand response can complement an individual’s higher education levels. Formal training can help compensate for a lack thereof. Thus, building highly specific, duty-related educational capital should be a primary career field line of effort. DEFED implementation is a positive step to introducing contextualized duty-related education to the operations forefront. However, it is still evolving; it lacks the specificity to maximize the desired individual-specific results. Neuroscience education offers a novel approach to target development of key developmental skills in young adults.

How neuroscience education will affect the performance output for first-term Security Forces Airmen is not known. To derive probable effects, the researcher reviewed more robust research from cross-functional medical fields. Patient education aimed at facilitating patient knowledge base to improve a patient’s health behaviors, health status, or both have implications here (Louw and Puentedura 2013, 28). In the context of this study, neuroscience education aims to improve self-understanding of brain functions and limitations to enhance young adult duty performance.

Patient education is a powerful therapeutic tool. According to Louw and Puentedura,

> Current best-evidence research indicates that when a therapist explains to a patient the neurobiology and (neuroscience) of their pain experience and the patient truly understands it, they have less pain, less disability move better, perform better with rehabilitation, have better cognitions regarding their pain, and experience decreased sensitization of their nervous system. (Louw and Puentedura 2013, 47)

Patient familiarity with neuroscience education is often as powerful as traditional therapy and drug protocols. The potential impacts of teaching young adults about the brain's structure and inner-workings should not be understated. Adaptations of therapeutic neuroscience education-based protocols are successful in achieving desired results.

A recent study informed early teens on their brain's structure and functionality, brain plasticity and myelination, and a clear message that they had control over brain development (Blackwell, Trzesniewski, and Dweck 2007, 262; Jones 2010, 11). The results were significant. Educating early teens on neuroscience education initiated changes from fixed mindsets to malleable growth mindsets. Once the subjects understood they were the responsible agents for their thoughts and brain growth, they changed their learning pathways.

The differences between the experimental and control groups were substantial. Over a two-year period, the experimental group experienced a continuous upward trend of scholastic performance. Those who did not receive neuroscience education experienced a downward trend commensurate with the experimental group. The resulting disparity in performance between the two groups is significant to this study.

A key consideration behind the study's result is the average age of the study's participants. First-term Security Forces Airmen are primed to receive similar education. The researcher asserts similar duty performance results are possible. Creating awareness of brain structure and functions will "nudge" many young adults to take an active role in their professional and intellectual efforts. Even if results are modest, improvements applied across the entire career field are significant in both short and long-term effects.

Criterion 2: Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk? The answer to this question is Yes. Research clearly indicates the power of basic neuroscience education concept awareness. Yet, neuroscience education is not a panacea in and of itself. It should not be applied haphazardly. Tiered education programs targeting specific small groups will produce the greatest benefits. Synthesizing duty related aspects with neuro functioning may further amplify effects.

Table 3. Step Two: Likelihood of Improvement Criteria

Secondary Question Being Evaluated	No	Qualified Yes	Yes
2) Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?			X

Source: Created by author.

The next section, Step Three, determines whether or not Security Forces can to lead neuroscience education independently. Many installations maintain mental health

professionals trained in neuroscience fundamentals. However, professional obligations and conflicts of interests limit their ability to lead or assist frequent training sessions. This question seeks to determine if complex neuroscience training can be delivered by Security Forces Airmen effectively. Step Three of this research design answers “Does Security Forces possess organic capability to lead neuroscience education training?”

Step Three: Training Capabilities

Cross-functional neuroscience application is not a new concept. For example, educational integration with neuroscience has roots reaching to the 1960s (Devonshire and Dommett 2010, 349). However, despite new brain understandings derived from the development of research technologies, cross-functional neuroscience integration is only mildly successful. Understanding common neuroscience language, research literacy, ability to derive application, delivery methods, and time are common barriers. These barriers are not easy to overcome.

Research confirms the effective application of neuroscience education requires the facilitator to understand brain function fundamentals to a greater degree than their audience (Louw and Puentedura 2013, 56). The facilitator must then have the ability to confidently express brain concepts in ways that are comprehensive, yet understandable. Understanding brain function complexities is a tall task. The difficulty lay in developing an appropriate training and education track to prepare program facilitators adequately.

The current DEFED train-the-trainer course consists of 24 contact hours covering ten training modules. This level of training is appropriate to grasp generalized DEFED concepts. It is enough to introduce core DEFED concepts. However, a one-time train-the-trainer course is not enough to develop deep knowledge on specific brain pathways.

Alone, this training is inadequate to advise changes to training, operations, or leadership significantly. In addition to formal DEFED training and periodic professional military education, facilitators must engage in regular self-study. This consideration makes the selection of DEFED facilitators as important as the program itself.

Neuroscience self-study requires an ability to interpret data; it requires research literacy. Facilitators must be not only well respected members of the unit but also willing to engage in self-learning the intricacies of complex subject matter on their own time. Facilitators must possess a curiosity to conceptualize how neuroscience research data applies to their unit's particular challenges. However, Security Forces has not done well in developing self-learning as a part of professional development; it is not a generally embraced cultural norm.

For neuroscience education to become a viable aspect of DEFED or CAF, Airmen must accept self-learning as a part of the Security Forces warrior ethos. Based on personal experiences, the self-learning requirement limits the pool of prospective facilitators significantly. The limited facilitator pool is positive, especially early in the integration process. A smaller guiding coalition can build the legitimacy of neuroscience education and application. Legitimacy is equally important to programmatic success as the delivery methods.

In addition to having a firm grasp of neuroscience information, facilitators must distill complex topics into non-threatening, understandable concepts. Clinical therapeutic neuroscience education research indicates educational sessions that use only biomedical information, i.e., anatomy, biomechanics, and physiology, to educate patients about pain produces negative results. At best, the newly acquired biomedical education provides

little results; at worst, it appears overwhelming concepts and complicated lexicon reinforce anatomical sources of pain and induce fear (Louw and Puentedura 2013, 30). Placed in context, facilitators must use caution in overwhelming their audience with clinical vernacular. Facilitators must maintain a balance between neuroscience education concepts and base-level comprehension. The intent is to derive understanding and application from neuroscience education, not to create clinical-level practitioners.

Neuroscience education facilitation includes any instruction or activity meant to improve a young adult's knowledge base. But increasing a knowledge base is not enough. Education must relate to application to generate desired results. Therefore, how facilitators deliver information is as important as the information itself.

The delivery format influences the effectiveness of the information presented. In clinical practice, metanalysis indicates one-on-one education sessions produce superior benefits to group settings (Louw and Puentedura 2013, 45). Smaller sessions allow for greater facilitator-to-Airman and Airman-to-Airman interactions. Additionally, it allows facilitators to engage in meaning-making by connecting concepts with experiential application. Motor-learning theory-based training programs infused with neuroscience education is an appropriate training arrangement for Security Forces.

As mentioned in Step Three, a significant roadblock is time. Rather than seeking more time to lecture neuroscience education topics, facilitators must seek to link topics synthetically across all domains of home-station training. This will be difficult to accomplish in the short-term. However, as awareness develops concepts become understood; as information saturation builds, progress will occur.

Criterion 3: Does Security Forces possess organic capability to lead neuroscience education training? Current DEFED and CAF training courses demonstrate Security Forces Airmen have the capability to understand and deliver neuroscience education capabilities. However, time is the enemy. Formal train-the-trainer courses similar to DEFED's construct would be sufficient to provide neuroscience education familiarity but not a deep understanding. Positive training indicators are greater when the facilitator is highly-trained rather than chosen from available pools of candidates (Eidelson, Pilisuk, and Soldz 2011, 3). Security Forces leaders should challenge traditional norms and adopt concepts similar to Lykke's 3-legged stool model. Based on literature reviews of therapeutic neuroscience education and various designs for how people learn, the answer is a Qualified Yes.

Regarding education, Lykke's model emphasizes the balance between three domains: formal training, professional military education, and self-study. The first two are sufficient; the latter is inadequate. After more than a decade of war coupled with the stress of massive organizational transitions, i.e., manning and resources fluctuations, transition to Installation and Mission Support Command, etc., it is not surprising emphasis on self-education declined. However, Security Forces leaders at all levels must restore the importance of self-education. Without the emphasis on unit facilitators to extend their knowledge beyond the formal training foundations neither neuroscience education, DEFED, nor CAF will not reach full potential.

Table 4. Step Three: Training Capabilities Criteria

Secondary Question Being Evaluated	No	Qualified Yes	Yes
3) Does Security Forces possess organic capability to lead neuroscience education training?		X	

Source: Created by author.

After applying the evaluation criteria to each secondary question, the next step, Step Four, is to aggregate the findings. Aggregation leads to answering the primary research question.

Step Four: Aggregation of Data

Evaluated data aggregation produced the following results.

Table 5. Response Evaluation Criteria Aggregation

Secondary Questions Being Evaluated	No	Qualified Yes	Yes
1) Are neuroanatomical and physiological response fundamentals relevant to Security Forces?			X
2) Can neuroscience education improve first-term Security Forces Airman performance and reduce tactical risk?			X
3) Does Security Forces possess organic capability to lead neuroscience education training?		X	
Total	0	1	2

Source: Created by author.

Evaluation criteria aggregation suggests that Security Forces should incorporate specific neuroscience education aspects. Response evaluation criteria findings criteria indicate neuroscience education can enhance young adult performance outputs and decrease judgment-related risks through improved training, operational, and leadership designs. Security Forces' ability to organically lead neuroscience education is a potential problem, especially early in the integration process. However, neuroscience education application is not a quick-fix program. It will take time to build and normalize organic intellectual capital to actualize neuroscience education benefits.

Security Forces senior leaders must resist the urge to track broad correlations between measures of performance and measures of effectiveness early in the integration process. Measuring effectiveness of neuroscience education is a difficult task. The difficulty lays in determining what can and cannot be measured. Measures of effectiveness for neuroscience education, DEFED, or CAF are highly individualistic; they are difficult to generalize into easily consumable metrics. The "goal problem" will frustrate some leaders. Senior leaders and program administrators must agree on common measures. They must also avoid seeking measures that cannot be assessed accurately.

Step Five

Conclusions and recommendations are the last steps to this research method. Chapter 5 presents conclusions and recommendations.

Chapter Summary

Should Security Forces incorporate neuroscience education into training for first-term Airmen? The answer is yes, but there are some problems with training. The

literature review, data presentation, and analysis indicate implications of neuroscience education on commander risk calculations and mitigations. Further implications address first-term Security Forces Airmen judgment and decision-making deficiencies during high-threat situations. While the researcher answered the primary question declaratively, the answer is not the sole outcome of the research. From the data presentation and analysis, chapter 5 outlines conclusions and recommendations.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

> Fear is a normal human emotion. It is not in itself a killer. We can learn to be aware when fear grips us, and can train to operate through and in spite of our fear. If, on the other hand, we don't understand that fear is normal and has to be controlled and overcome, it will paralyze us and stop us in our tracks. We will no longer think clearly or analyze rationally. We prepare for it and control it; we never let it control us. It if does, we cannot lead.
>
> — Colin Powell

Chapter Introduction

The final chapter of this grounded theory study on young adult brain functionality and its impact on operational performance includes a restatement of the research problem, a review of the research methodology, conclusions of the findings, recommendations to senior Security Forces leaders, and recommendations for future research.

Restatement of the Problem

The problem in this grounded theory-based study stems from the fact young adult first-term Security Forces Airmen are performing in roles for which their brains are ill prepared. If reliance on a core population of young adults is Security Forces' "left limit" and brain maturation is incomplete until age 26 is the "right limit," what can be done to help close the resulting gap? Information and training on stress management and resilience are available to Security Forces Airmen. However, there is no significant information available regarding neuroanatomical design, function, and implications for

young adults in highly contextual and threatening situations. This research study explored relevant information in these areas.

Review of the Research Method

Grounded theory methodology allows greater depth and contextual understanding of information directly applicable to Security Forces law enforcement and combat-related operations. More importantly, it focused on the organization's most vulnerable population: young adult first-term Security Forces Airmen. The researcher's background and education, first-hand Security Forces experiences, and distillation of technical neuroscience data melded to yield a comprehensive inspection of the research question.

The researcher served as the primary instrument of data collection and analysis. I built a substantive theory framework by gathering, reviewing, and analyzing data, and using intuitive and contextual understandings gleaned from professional experience (Merriam and Tisdell 2016, 17). I acknowledged the presence of several biases and threats to validity. I applied appropriate mitigation measures to minimize bias and threat effects to research and conclusions.

This research methodology allowed the researcher to use the constant comparative method of data analysis to identify common themes and patterns. The resulting themes and patterns were arrayed in relationship to each other to guide the researcher's core category identification (Merriam and Tisdell 2016, 32). The identification of the main conceptual element resulted in the substantive hypothesis development.

Research questions guided the primary data collection. Information collection intensity varied depending on the secondary research question's complexity and data availability. Research continued until the researcher derived sufficient information to

discern emerging data points. The data points allowed the researcher to answer the secondary research questions declaratively. Answering the secondary questions formed the basis to answer the primary research question declaratively.

Conclusions

Future Security Forces Airmen will encounter intense scrutiny and cognitively challenging environments at tactical, operational, and strategic levels. If those premises are accepted, Security Forces must consider whether current training methodologies are sufficient to develop young adults into the critical and creative thinking leaders needed for tomorrow. Security Forces Airmen must physically prepare to operate in restrictive anti-access/area denial environments; they must cognitively prepare to thrive in ambiguous and chaotic environments.

The brain's survival-over-performance paradigm should be of particular interest to Security Forces commanders and young adult first-term Airmen alike. The intrinsic requirement to operate in high-stress and quick-decision environments is a dangerous risk for young adults who lack the neuroanatomical capacities to perform law enforcement or combat-related duties at near zero-defect levels. Understanding the intricacies of how brain function differs and develops between adults and young adults presents significant challenges and implications for commanders and supervisors of first-term Security Forces Airmen.

The decision to help young adults understand themselves, enhance metacognition, and improve both speed and clarity of their decision-making cycles will both lower tactical risk and help to attain a position of relative advantage over adversaries. Neuroscience education concepts open innovative approaches to optimize training and

operational considerations in a time and resource constrained career-field. Security Forces senior leaders should have not only a collective interest in neuroscience education concepts but also the application and long-term impacts to Security Forces Airmen operational capabilities.

The implementation of DEFED is a significant step in incorporating important neuroscience concepts into operations to mitigate effects of career-field evolutions (USAF 2011, 22). However, DEFED's current programmatic design to address specific, contextual performance gaps at the points of greatest risk: young adults in positions of authority determining whether to use use-of-force applications and at what duration and magnitude. Regardless, DEFED provides an excellent framework from which to build future neuroscience education development capabilities.

If Security Forces senior leaders decide not to adopt neuroscience education as a core operating principle, operations will not look much different than they do today. But the problem is not today; it is tomorrow. As a career field, Security Forces must consider how it will contribute to tomorrow's fight and determine if current training and development are sufficient. Perhaps Security Forces is comfortable with its vector; perhaps there are other aspects demanding priority attention.

What does the future look like with adoption of neuroscience education as a Security Forces core concept? It is not definitively known. Based on the current neuropathy research, systematic reviews showed that educating people in pain about their pain is a more advantageous approach than traditional biomedical education (Louw and Puentedura 2013, 40). Applied cross-functionally, accumulating scientific knowledge indicates neuroscience education could benefit a wide range of learners; from children to

the elderly (Firth 2011, 1). Applications of critical and creative thinking can conceptualize important neural functioning implications with leadership, training, and numerous operational considerations.

Neuroscience education is not meant to apply to the exclusion of other programs. On the contrary, neuroscience education is a complementary element to virtually any program. Neuroscience education improves conceptualization and understanding if a program's design and desired effects are in alignment. If one does not understand and apply neuroscience to the program, it will likely produce results, but not at the level or magnitude possible.

Neuroscience education often is described as the science of hope. The brain is not fixed; it is pliable and ever-changing. How one thinks, acts, and operates today is not destiny for tomorrow. Your connectome is changing now as you read these words. Educating young adults on the current limitations of their brain fuels motivation; describing the results neuroscience education can produce tangible training targets. If Security Forces adopts as a foundational premise that the brain is the target of all training, not only will DEFED and CAF programs benefit but so will all aspects intrinsic to training a professional force.

Recommendations for Decision Makers

The findings have implications for both further study and potential implementation by Security Forces senior leaders. The recommendation list is not intended to be all-inclusive; it is a starting point. Other recommendations inevitably will develop as the reader applies personal experiences and expertise. The data suggests six primary recommendations for Security Forces senior leaders.

Recommendation 1

Neuroscience education should be incorporated as a proactive performance element to improve first-term Security Forces Airmen's metacognition capabilities. Neuroscience evidence should inform the 'why' behind the 'what' of law enforcement and combat support procedures and decision-making processes. Creating awareness that limitations are present creates a natural motivation to want to reduce those gaps. DEFED is the vehicle to deliver that contextual education. I recommend the DEFED program integrate foundational and refresher "Neuro 101" courses for all first-term Security Forces Airmen.

Neuro 101 courses should aim to inform young adults on the brain's structure and how its design affects judgment and decision-making. Chapter 2 outlines key research concepts appropriate for a Neuro 101 level course. Likewise, a long-term DEFED strategy should include tiered neuro courses designed for matured Security Forces officers, noncommissioned officers, and civilian personnel. The resultant understandings at junior and senior levels would benefit leadership and administrative developmental designs.

Recommendation 2

Creating awareness of biological limitations in young adults is the first step to elevating performance. The next step is to re-conceptualize unit training program designs. Unit training programs should specifically consider young adult neuro limitations while deliberately striving to "close the gap" between them and their mature adult counterparts. Trainers should receive additional training describing effective training methodologies grounded in neuroscience to close existing neuro gaps. I recommend Security Forces

develop specialized “train-the-trainer” programs tailored for unit-level, regional training center, and Security Forces technical training instructors.

Recommendation 3

Neuroscience information is prevalent in popular culture. However, not all data available is reliable or relevant to young adults or Security Forces. Trainers and commanders tend to personalize programs. Irresponsible or “unauthorized” implementation concepts which do not have a sound basis in science may at best waste time; at worst, may inculcate poor motor habits or spawn ethical concerns. I recommend DEFED administrators produce and periodically disseminate “Security Forces Approved” program updates. Providing program updates via downloadable products and conference calls will help clarify complex information, improve networking, and curb implementation of anecdotal or unreliable research. Periodic updates, i.e., quarterly newsletters or notices to Airmen, also improve the novelty of information and establish a framework supporting constant organizational improvement.

Recommendation 4

Both CAF and DEFED have similar lines of effort. However, they are not explicitly synchronized with one another and do not reflect the granularity to prevent redundancy. If USAF senior leaders do not exempt Security Forces from CAF participation, DEFED should be reorganized to leverage CAF and its resources as a foundational element. DEFED should reduce redundancies and become complementary to CAF to increase efficiency and offer more in-depth, comprehensive training. Resilience is just one part of the performance coin. I recommend as a career field,

Security Forces consider, design, and publicize a clearly defined human performance strategy. The Army Warfighting Strategy #9 crosswalk provides an example of appropriate detail (figure 8).

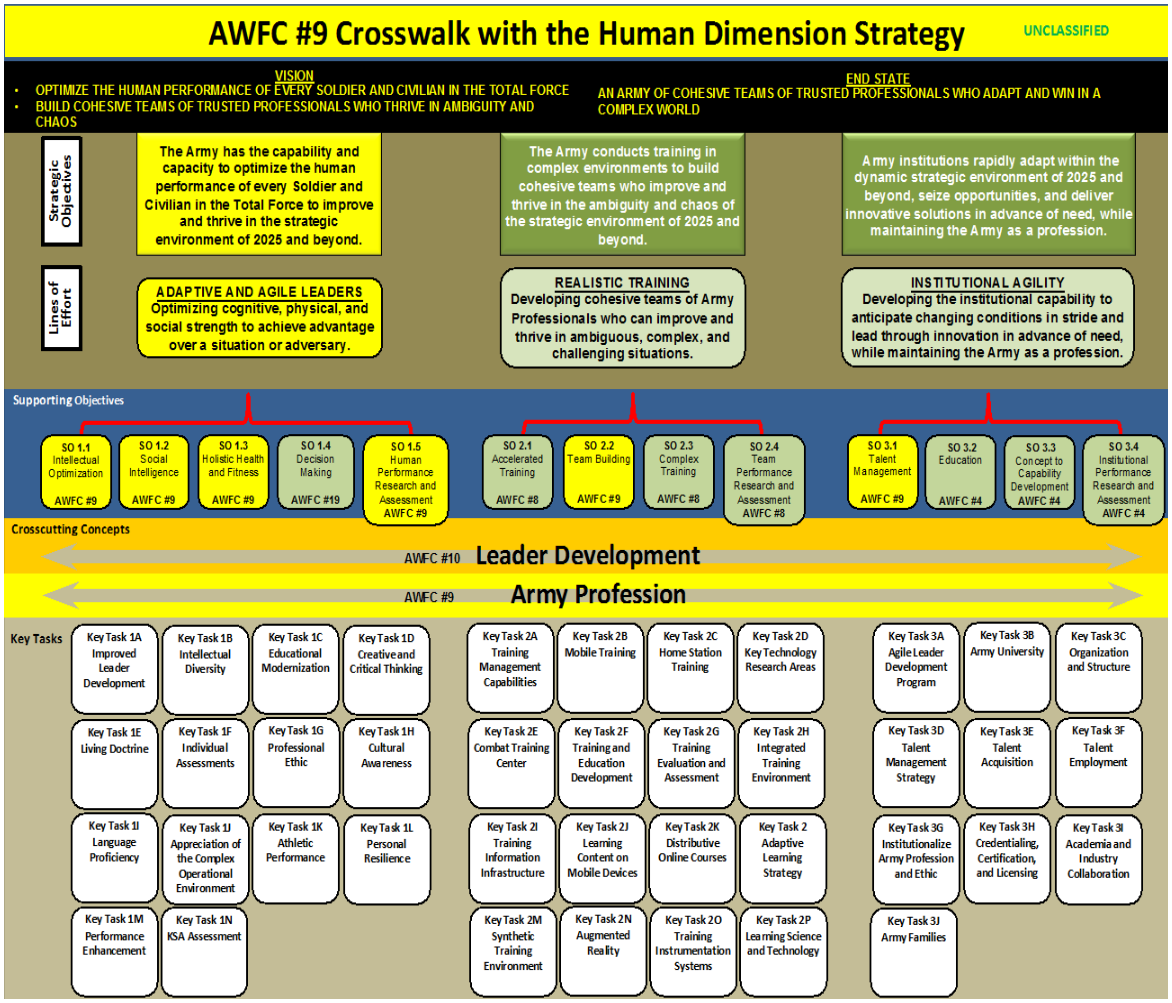

Figure 8. Army Warfighting Challenge #9 Crosswalk with the Human Dimension Strategy

Source: John M. McHugh and Raymond T. Odierno, *The Army Human Dimension Strategy* (Washington, DC: Government Printing Office, 2015), 22.

Recommendation 5

The DEFED initiative is a major step to enhancing the professionalism of the Security Forces career field. DEFED will make long-term, meaningful contributions to the Security Forces human domain. However, fiscal uncertainty threatens the program and makes long-term planning and adaptation difficult. As of 10 February 2017, DEFED is not a program of record and does not have dedicated financial resources tied to the initiative. Lack of dedicated funding creates a perceptual uncertainty of the long-term future of DEFED. I recommend Security Forces strive to make DEFED a program of record similar to CAF.

Recommendation 6

I recommend Security Forces develop a list of enduring "Defender Challenges." Security Forces should offer these topics to officers and senior noncommissioned officers before attending mid- and late-career professional military education. The intent of Defender Challenges is to identify problems in need of research, both neuroscience and non-neuroscience related. I do not recommend mandatory directives to complete research studies on these problems. However, having a list of items that seek positive change in Security Forces may encourage self-directed research participation.

Recommendations for Future Research

The primary concern is to understand what effects the information in this grounded study produces. How does neuroscience education affect young adult performance in threatening situations? The answer is not known. Longitudinal quantitative studies on the results of neuroscience education might be appropriate if

funding becomes available. Researchers may seek applications similar to Dr. Lorimer Moseley's neuroscience education work in the chronic pain field as a foundational approach to neuroscience education. Moseley's research serves as a successful model to determine the efficacy of combined neuroscience education and practical training to produce functional measures of effectiveness.

Second, additional inquiries into other neuroscience-based concepts should be explored to determine effectiveness as applied to other Security Forces performance aspects. Concepts and theories such as visual acuity training, motivational interviewing, motor-learning theory, the adult learning model, and psycho-neuromuscular theory provide interesting topics for future research. These models offer novel approaches to address common Security Forces problems. However, Security Forces must be willing to embrace new strategies in lieu of traditional methods for them to be successful. Identifying the right approaches to address core problems while remaining rooted in neuroscientific data is a good approach.

The knowledge and experiential data sought to increase performance are not limited to university research studies and governmental think tanks. The expertise, knowledge, and experience to support the information in this grounded study exist in our ranks, on our bases, and within our military educational institutions. Security Forces should seek to leverage their assistance to gather additional information and perspectives on this research study's subject. The findings from this grounded study might serve as an appropriate foundation for research inquiries using other commonly accepted survey and research methodologies.

Summary and Parting Thoughts

Neuroscience education will not solve all Security Forces-related problems. However, targeted education is Security Forces' best chance to mitigate risk and prepare young adults for the rigors required and tomorrow's leadership challenges. Neuroscience education is a missing conceptual component that could enhance various Security Forces concepts and programs, especially DEFED. Embracing neuroscience education as a guiding principle will ensure Security Forces is rooted in science, is flexible to change, and prepared to evolve alongside tomorrow's human cognitive challenges.

As the U.S. transitions from an extended period of war into an interwar period, Security Forces must take full advantage of the time it has to prepare for roles in future conflicts. There should be distinguishable differences in how Security Forces Airmen train in wartime and interwar periods. Neuroscience education offers viable training support strategy to evolve operations. However, embracing neuroscience education as a foundational concept will require paradigm shifts in how Security Forces thinks about training and operations. As history repeatedly reveals, militaries and branches that fail to innovate within the naturally dynamic environments in which they operate are more apt to fail in future conflicts than those who do. Now is the time for Security Forces to reevaluate its long-term human performance domain programs and strategies.

> We now face another of those crucial moments in time. The dynamic, complex future is already beginning to challenge us. It is time for this generation of Airmen to develop a way to succeed.
>
> — Deborah Lee James

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